The effect of shape and cooking duration on preference and consumption of carrots in preadolescent children

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BACKGROUND & OBJECTIVES

Vegetables are one of the most difficult categories of food to introduce in children's diet (Cooke & Wardle, 2005) and children's low consumption of vegetables is pointed as a major source of public health concern in many developed countries. A better understanding of children sensory preferences could help to improve children's vegetables acceptance.

The present study evaluates the effect of shape and cooking duration of carrots on preadolescent children's preference and consumption. Carrots was previously identified as a well-known and appreciated vegetable in French children (Morizet et al., 2011)

METHODS

• Participants

597 children aged 8 -to -11 years (see table 1) have been recruited in **6 different schools** in the Rhône-Alpes region, France

Table 1. Participants characteristics

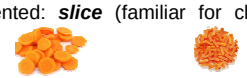
		8yr	9yr	10yr	11yr	Total
School 1	Female	16	10	16	8	50
	Male	11	14	11	5	41
						91
School 2	Girls	16	21	27	18	82
	Boys	23	21	30	10	84
						166
School 3	Girls	11	5	11	6	33
	Boys	10	4	13	6	33
						66
School 4	Girls	8	9	12	9	38
	Boys	15	12	16	9	52
						90
School 5	Girls	9	20	17	6	52
	Boys	15	8	13	9	45
						97
School 6	Girls	12	4	15	9	40
	Boys	7	7	19	14	47
						87
					Total	597

• Factors studied & Products

Two factors have been studied:

✓ **Shape**

Two carrot shapes were presented: ***slice*** (familiar for children) and ***stick*** (unfamiliar)



✓ **Cooking duration**

Two cooking durations were tested: **2min** and **15min**

Products were pre-cooked frozen carrots (Minute®, Bonduelle) salted (0.002g/kg) and then steamed (100°C) with 0.01g/kg of fat (margarine).

Table 2. Presentation plan

School canteen	Pair	Carrot sample
School canteen 1	Pair 1	Crunchy slices Soft slices
School canteen 2	Pair 2	Crunchy slices Soft sticks
School canteen 3	Pair 3	Soft slices Crunchy sticks
School canteen 4	Pair 4	Crunchy sticks Soft sticks
School canteen 5	Pair 5	Crunchy slices Crunchy sticks
School canteen 6	Pair 6	Soft slices Soft sticks

Products were presented in pairs (see table 2) to children with meat as a main course. One of the 6 possible pairs was served in each school canteens

• Procedure:

The experiment was conducted during usual school lunches. Children received a hot main course composed with either meat or fish and two different carrots

Children received a short questionnaire with:

✓ **a visual and a liking measures**:

3-point liking scale (Birch, 1991)

✓ **a visual and an « *in mouth* » preference test**:

Which vegetable do you prefer?

☐ *The one with the white fork* ☐ *The one with the green fork*

Before cleaning their tray, children were invited to pass them under a small video camera. This video recording provided us with the possibility to measure individual consumption since each tray was numbered. Children consumption were evaluated with a 4-point coding:

• Analysis

ANOVA were performed to establish significant differences in liking between products (y = *subject* + *product* + ...). Then each preference test data was analyzed with a binomial distribution in order to evaluate if one of the two products tested was significantly preferred. The consumption data was analyzed using ANOVA. Analyses were carried out using XlStat and the significance criteria was set at $p < 0.05$

SELECTED RESULTS

« IN MOUTH » MEASURES RESULTS

Whether they were crunchy or soft, no difference of « In mouth » **liking** was observed between carrot slices and carrot sticks. « In-mouth » liking ratings were higher when carrot slices were crunchy. No difference of liking was observed between soft and crunchy sticks

Crunchy carrot slices were preferred over crunchy sticks (p<0.0001). The difference was not significant between soft carrot slices and soft carrot sticks (p=0.247). "In mouth" **preference** for crunchy slices over soft slices was observed (p<0.005) and the same results were observed for sticks (p<0.05). Even soft, carrot slices were preferred to crunchy carrot sticks (p<0.0001)

Children **consumed** significantly more crunchy slices than soft slices (pair 1, F=11.676, p<0.001); and more crunchy slices than crunchy sticks (pair 2: F=27.503, p<0.001). Carrot slices, crunchy or soft, were more consumed by children than carrot sticks (pair 5: F=80.936, p<0.001; pair 6: F=22.430, p<0.001)

CONCLUSION & PERSPECTIVES

• Generally children gave higher liking and preference scores for carrots cooking during a shorter time. **Children like crunchy carrots more**

• **Carrot slices obtained higher ratings and were preferred to sticks of carrots by children**. Also, children consumed more carrot slices than carrot sticks

• Preference data displayed better discrimination than liking data. Consumption data confirmed declarative data collected with the questionnaire

• Interestingly, we observed that the preference for crunchy carrots (shortest time of cooking) seems to be modulated by the shape of carrots. The soft slices of carrots were significantly preferred when they were served with crunchy sticks. **We can hypothesize that sensory modifications induced by the short time of cooking did not have the same impact on children's judgement if he/she is familiar or not with the presented food**

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